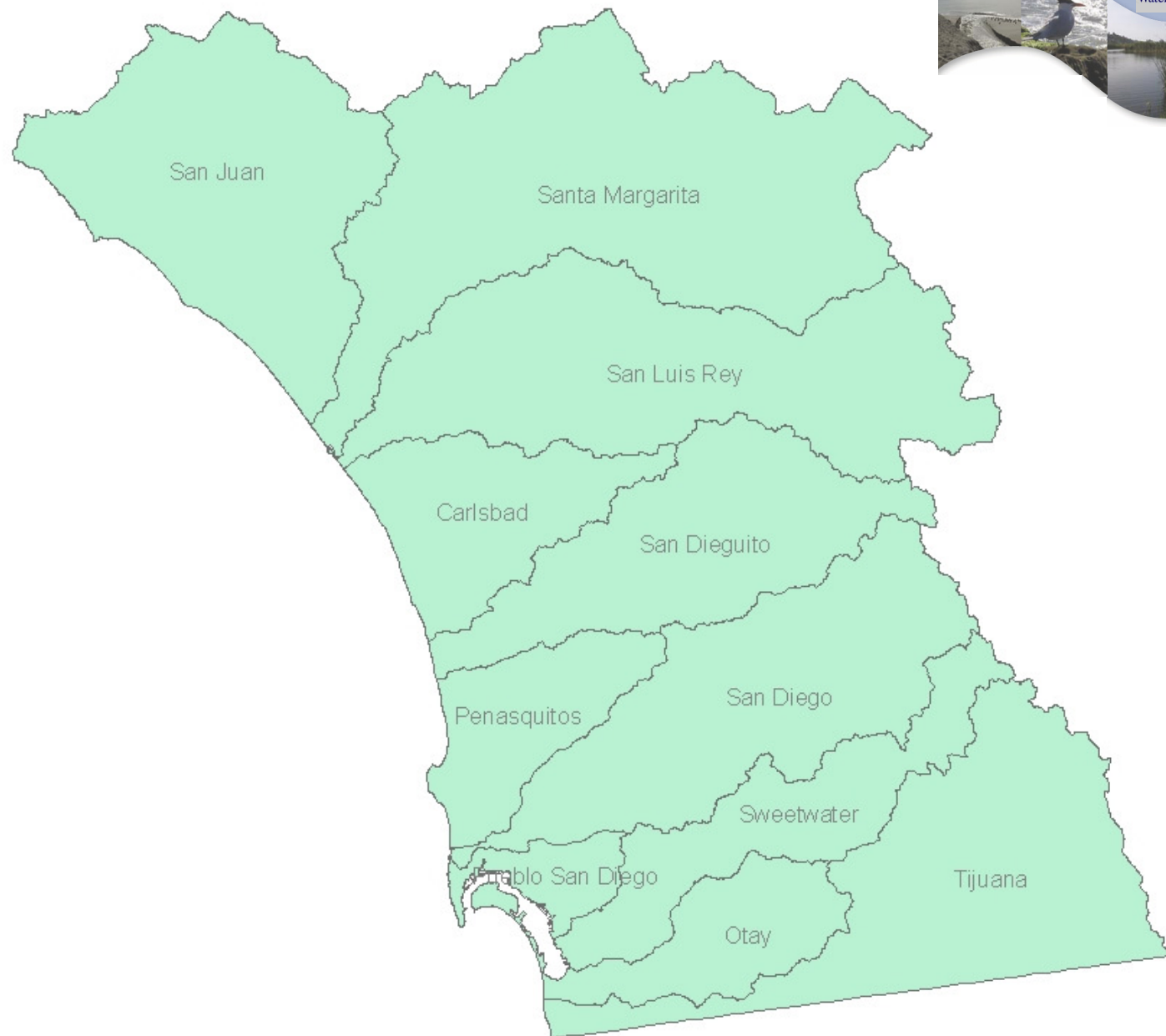# Biotic Integrity of streams in San Diego since 1998

Lilian Busse and Dave Gibson
San Diego Regional Water Quality Control Board
and
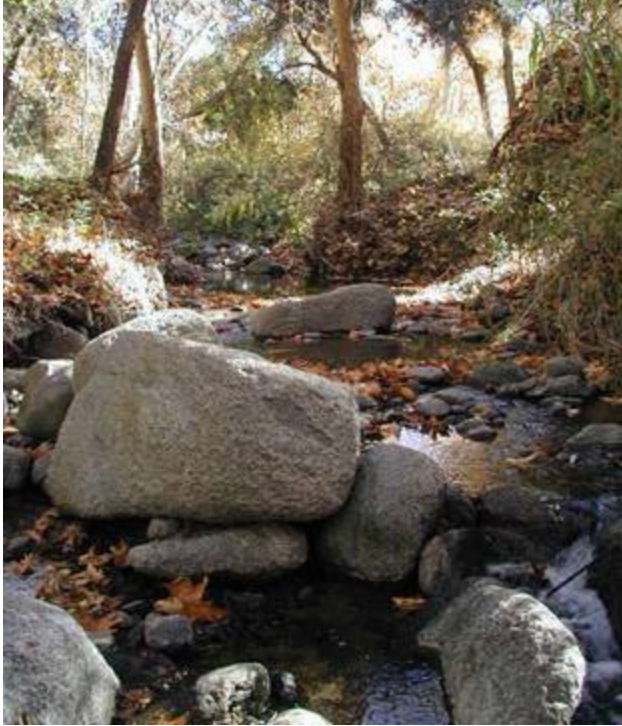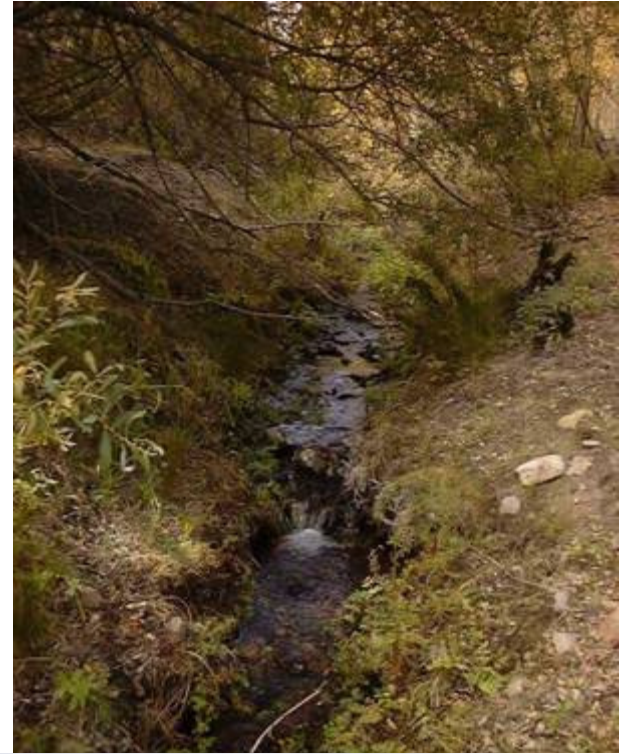Alex Pohlman and Kristofor A. Voss
National University, San Diego

NPS conference
May 6, 2007

Outline

- Overview of San Diego watersheds and streams

- Short introduction in bioassessment and IBI scores

- Bioassessment programs in San Diego since 1998

- Bioassessment methods

- IBI scores for:
- San Diego region
- Watersheds
- Reference sites
- Trends since 1998

- Correlations with environmental factors and diagnosis

- Next steps

San Juan

Santa Margarita

San Luis Rey

Carlsbad

San Dieguito

Penasquitos

San Diego

Sweetwater

Pueblo San Diego

Otay

Tijuana

Water Boards

Bioassessment

Bioassessment: evaluation of the biological condition of a water body using biological surveys of the structure and function of the community of the resident biota.

Biological communities
• reflect overall ecological integrity
• integrate the effects of different stressors and provide a measure of their combined impact
• integrate the stresses over time and provide an ecological measure of fluctuating environmental conditions

Index of Biotic Integrity (IBI)

<u>Biotic Integrity</u>: The ability of an aquatic ecosystem to support and maintain a balanced adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat within the region

Index of Biotic Integrity (IBI)

- is a diagnostic tool to measure biological integrity
- is a number that integrates several biological metrics to express a site's condition or health
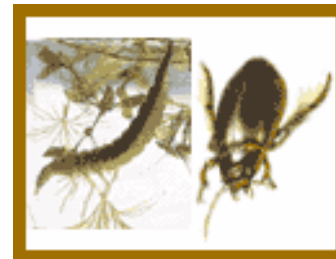
IBI in Southern California

- Ode et al. 2005: <u>Benthic macroinvertebrate Index of Biological Integrity</u> (So Cal B-IBI), 2005.

Seven uncorrelated and responsive metrics:
- Percent collector filterer + collector gatherer individuals
- Percent non-insect taxa
- Percent tolerant taxa
- Percent intolerant individuals
- Number of EPT taxa
- Number of Coleoptera taxa
- Number of predator taxa

IBI in Southern California

Metric Score	N_Coleop_T	N_EPT_T		N_Pred_T	P_CFCG_I		P_Int_I		P_NonIns_T	P_Tol_T
	All Sites	6	8	All Sites	6	8	6	8	All Sites	All Sites
10	>5	>17	>18	>12	0-59	0-50	26-100	36-100	0-8	0-4
9		16-17	17-18	12	60-63	51-55	24-25	33-35	9-12	5-8
8	5	15	16	11	64-67	56-60	22-23	29-32	13-17	9-12
7	4	13-14	14-15	10	68-71	61-65	19-21	25-28	18-22	13-16
6		11-12	13	9	72-75	66-70	16-18	21-24	23-26	17-19
5	3	9-10	11-12	8	76-80	71-75	13-15	17-20	27-31	20-22
4	2	7-8	10	7	81-84	76-80	10-12	13-16	32-36	23-25
3		5-6	8-9	6	85-88	81-85	7-9	9-12	37-40	26-29
2	1	4	7	5	89-92	86-90	4-6	5-8	41-45	30-32
1		2-3	5-6	4	93-96	91-95	1-3	1-4	46-49	33-36
0	0	0-1	0-4	0-3	97-100	96-100	0	0	50-100	37-100

Scores	0-19	20-39	40-59	60-79	80-100
Narrative	Very poor	poor	fair	good	Very good

Bioassessment monitoring in San Diego

- San Diego Regional Board (since 1998-2001)
- SWAMP (2003-2005)
- San Diego Stream Team (since 1998)
- Special Studies:
- Postfire special study (since 2003)
- San Diego Repeatability study (2003)
- Reference site study (2007)

- Municipal Stormwater Permit
- 401 certifications
- NPDES permits (e.g. Padre Dam)

Methods

- Sampling done by DFG, SDST, and Regional Board staff
- Method used: CSBP (California Stream Bioassessment Protocol
- Since 2007: SWAMP bioassessment protocol
- Sample processing: Department of Fish and Game (some by SDST)
- Current data storage: CalEDAS database
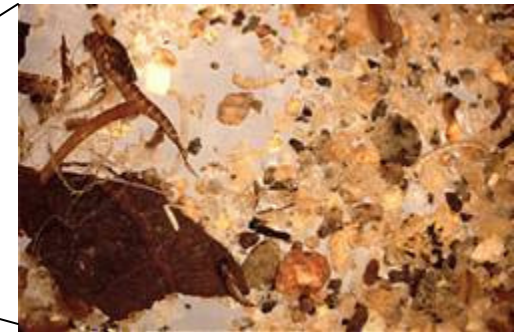- Future data storage: SWAMP database
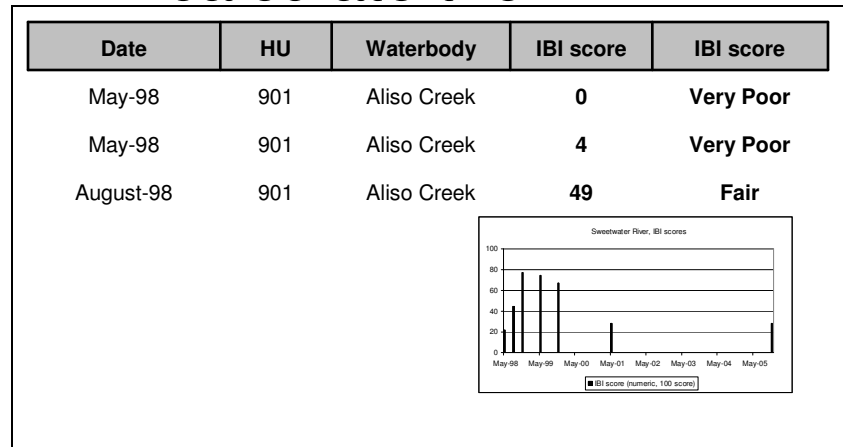- Data dissemination: EcoLayers

Methods

1. Take the samples
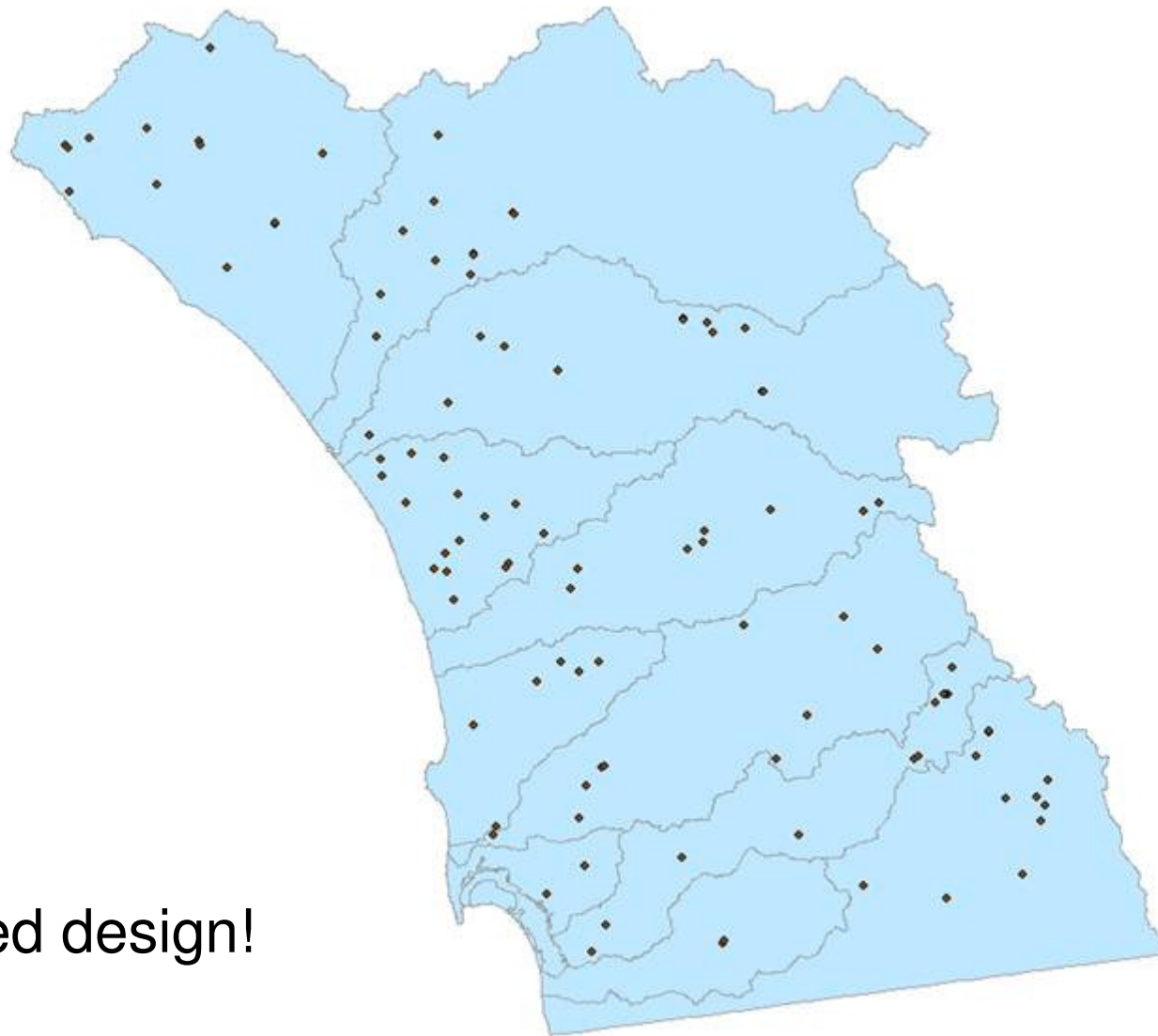
+PHAB
+physical parameters
+chemical parameters

2. Identify the species

3. Analyze the data and calculate the IBI

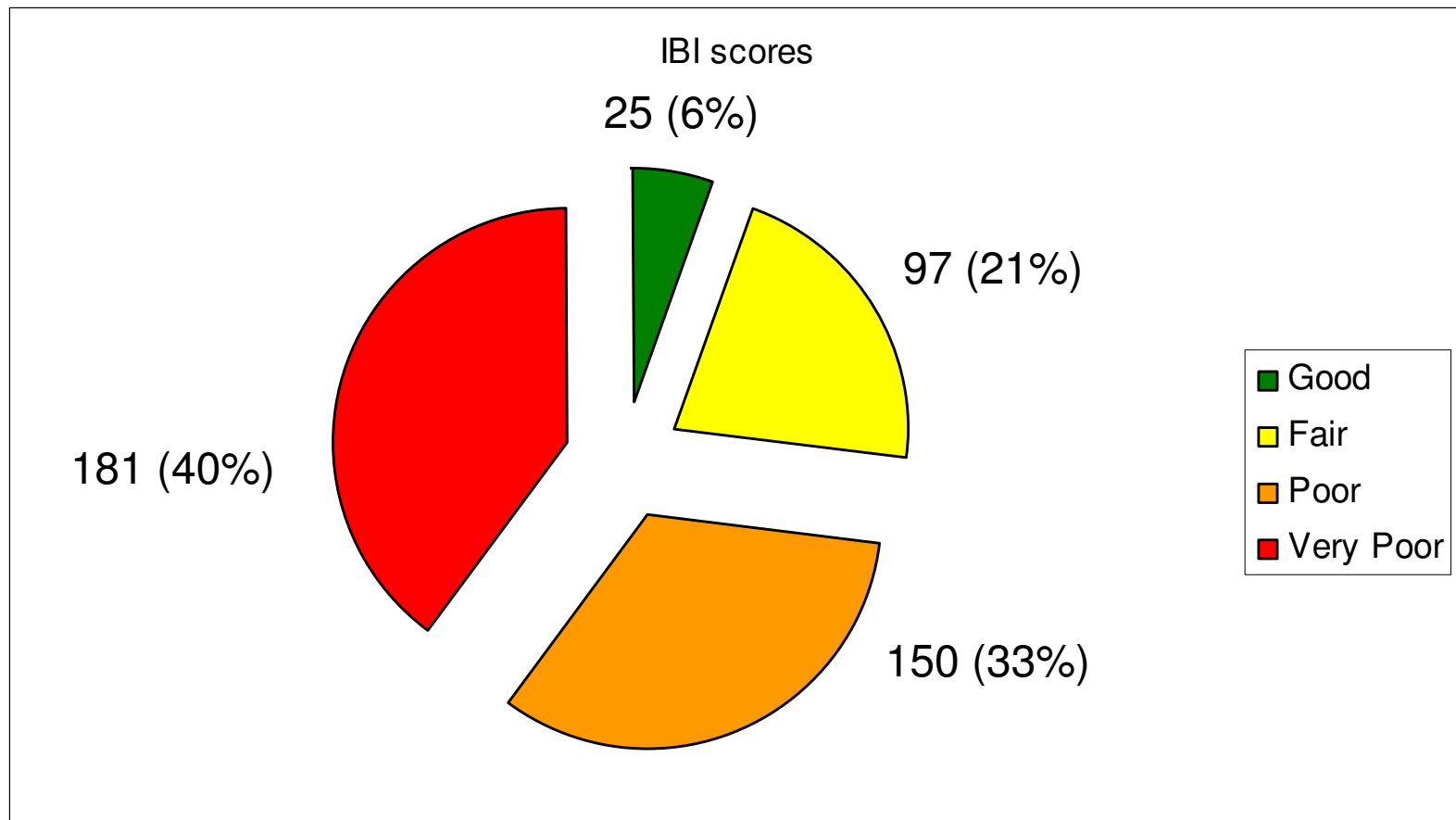| Date	HU	Waterbody	IBI score	IBI score
May-98	901	Aliso Creek	0	Very Poor
May-98	901	Aliso Creek	4	Very Poor
August-98	901	Aliso Creek	49	Fair

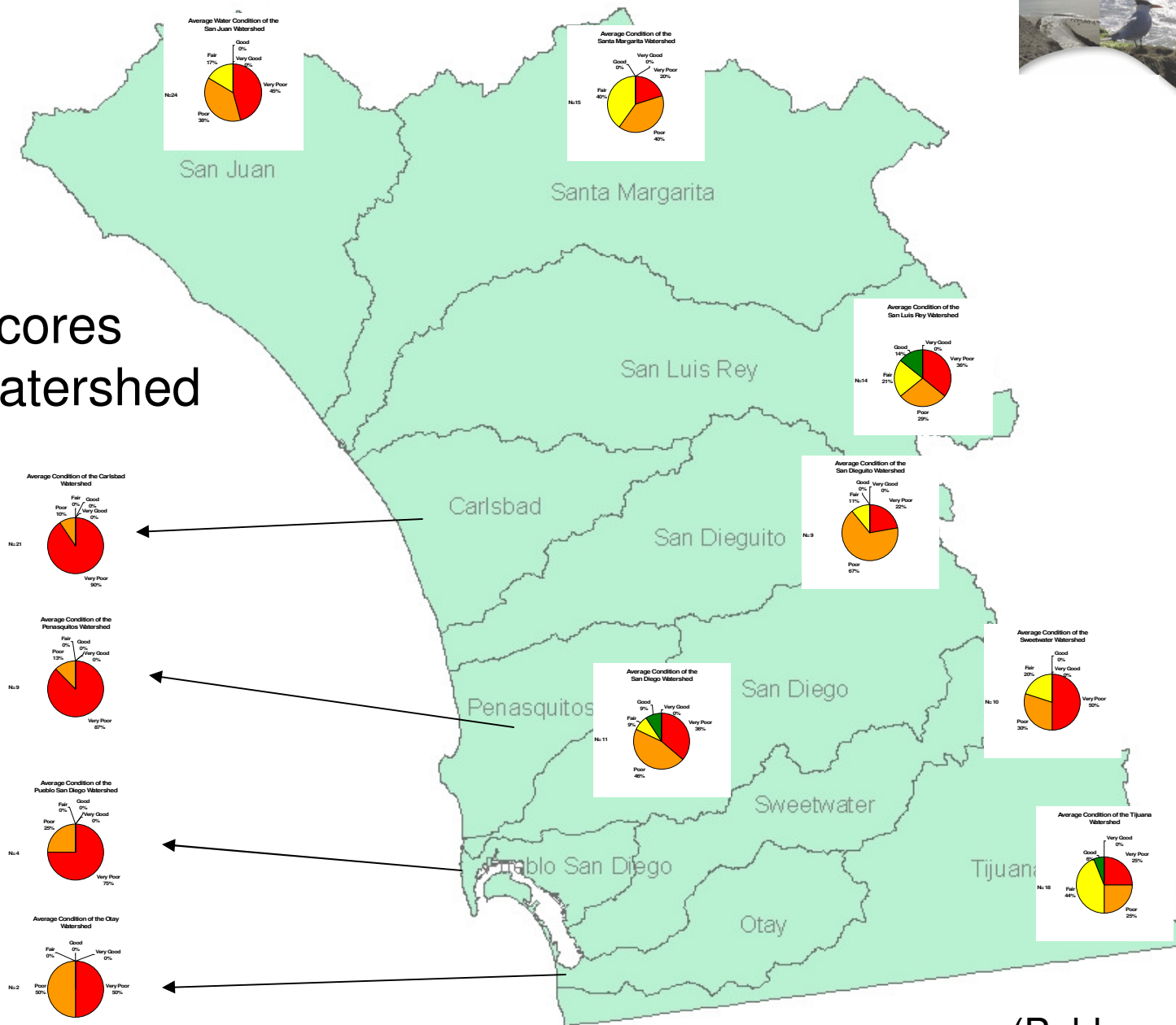# Map of bioassessment locations

Targeted design!

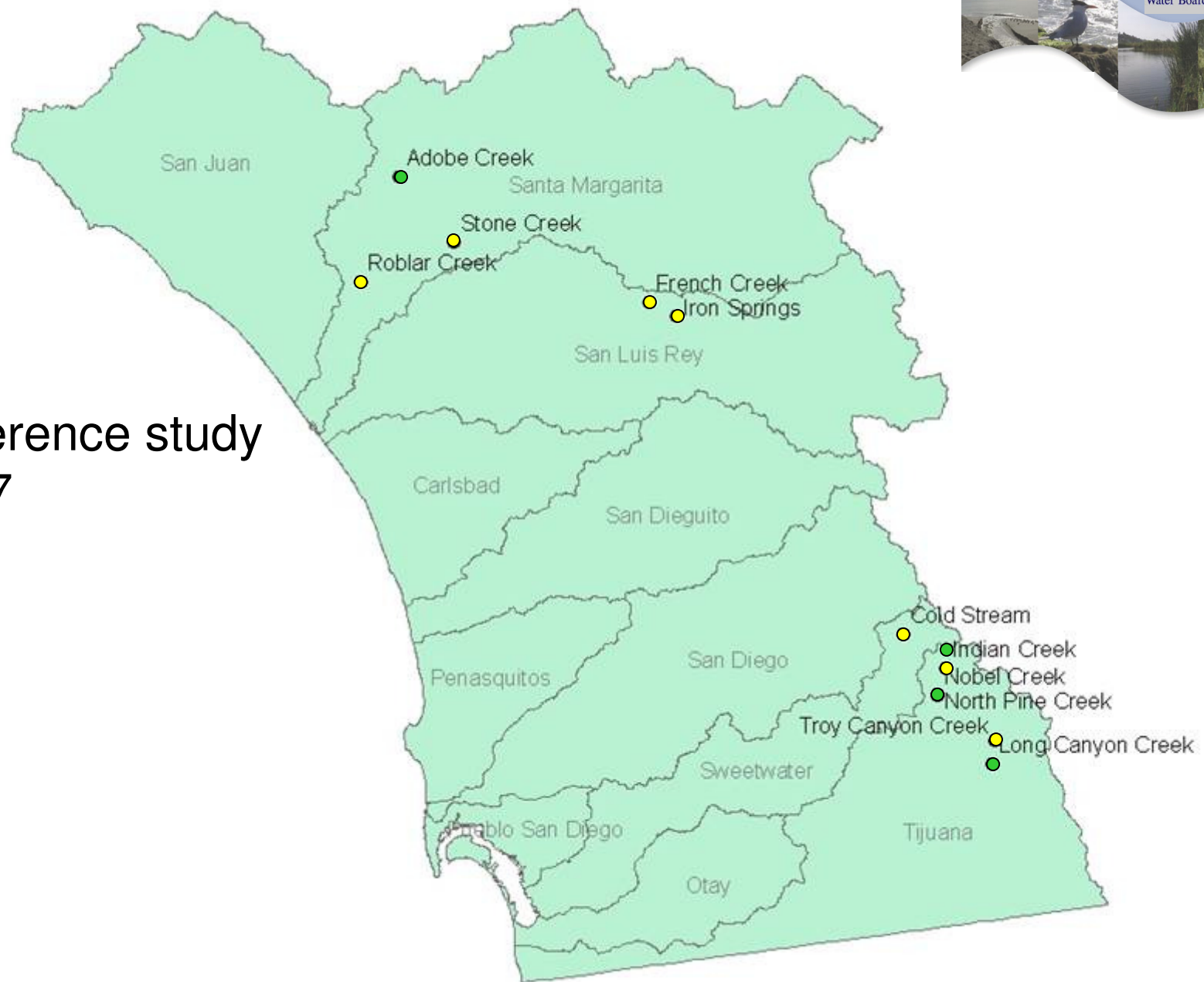# IBI scores in the San Diego region

Total of 453 samples

IBI scores by watershed

(Pohlman & Voss)

Reference study
2007

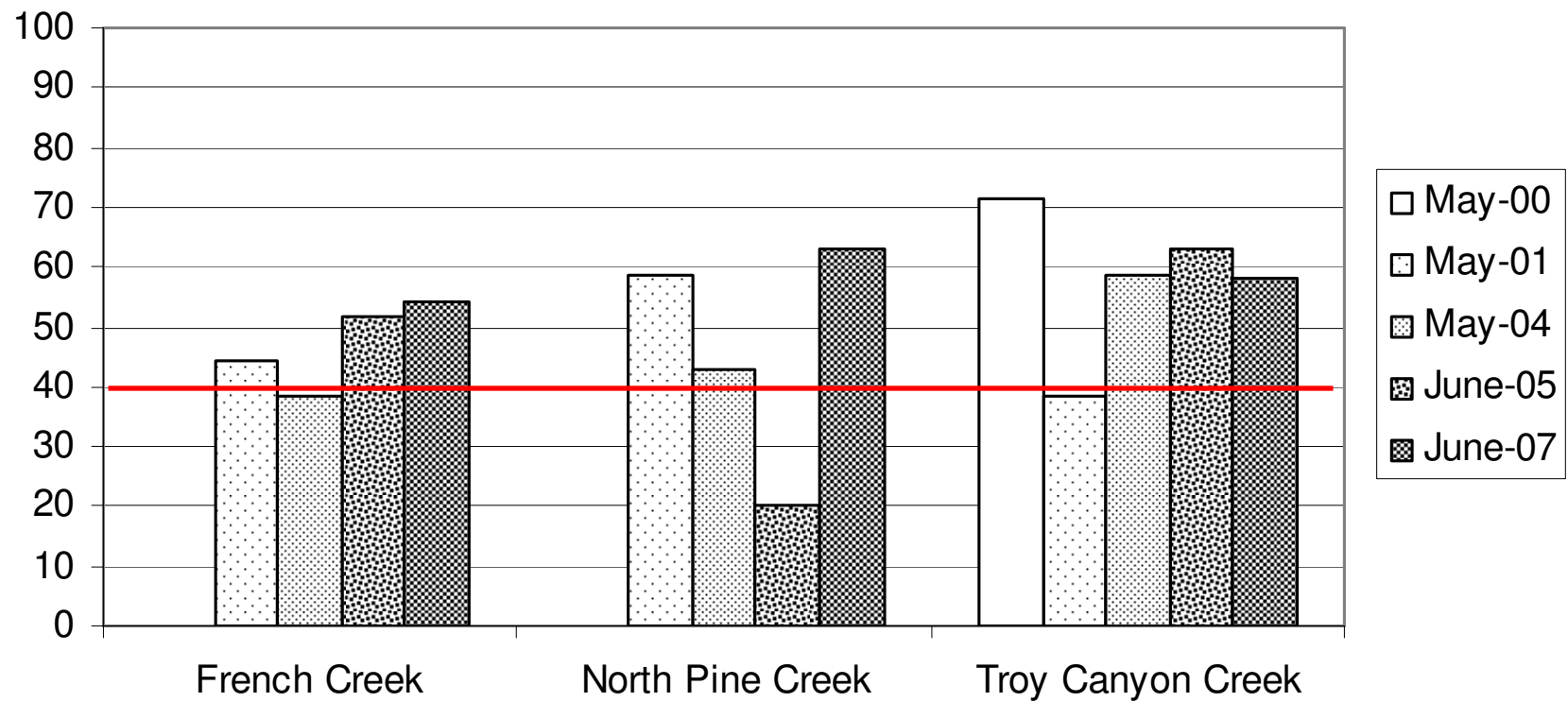# Trends in IBI scores

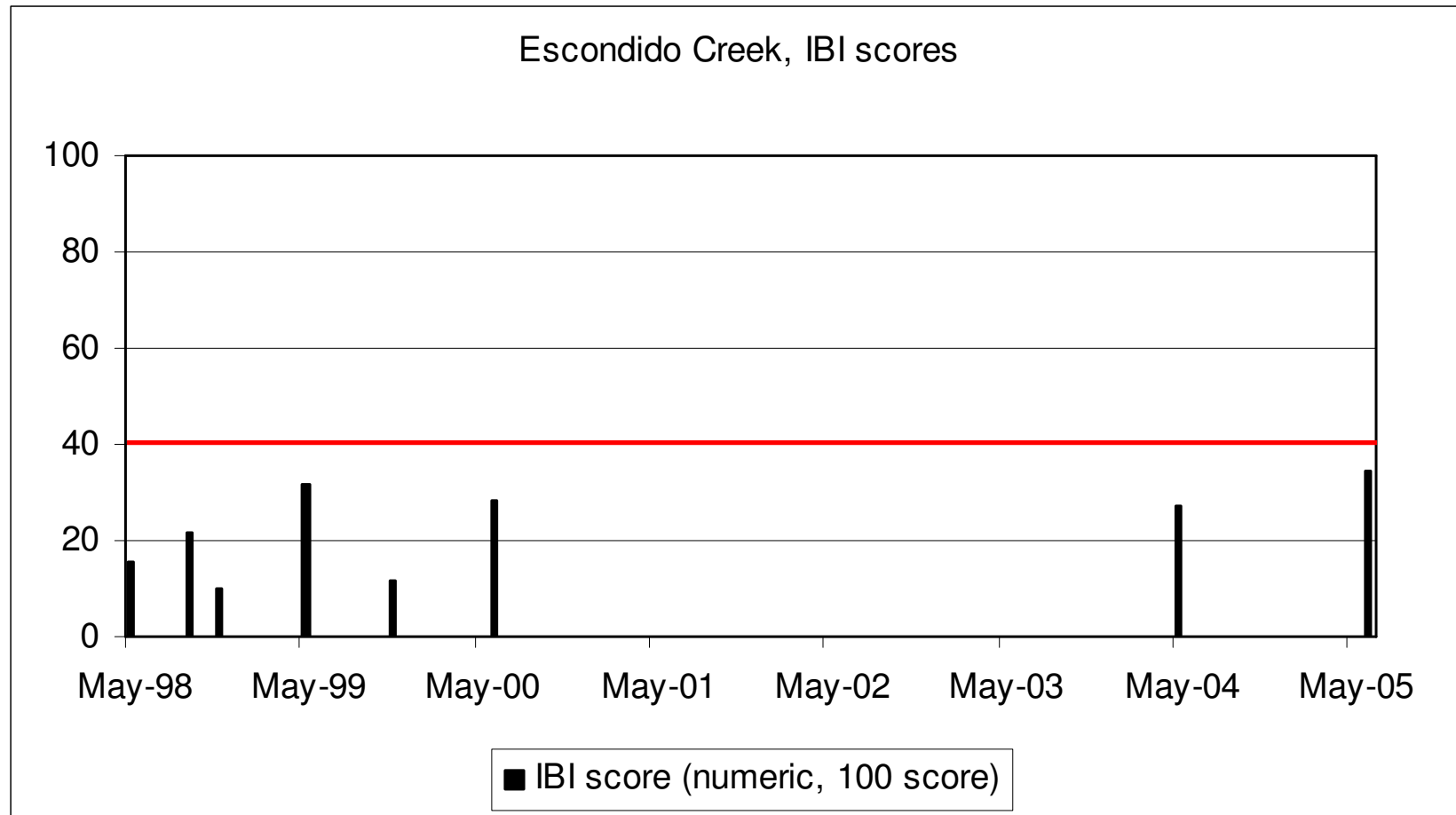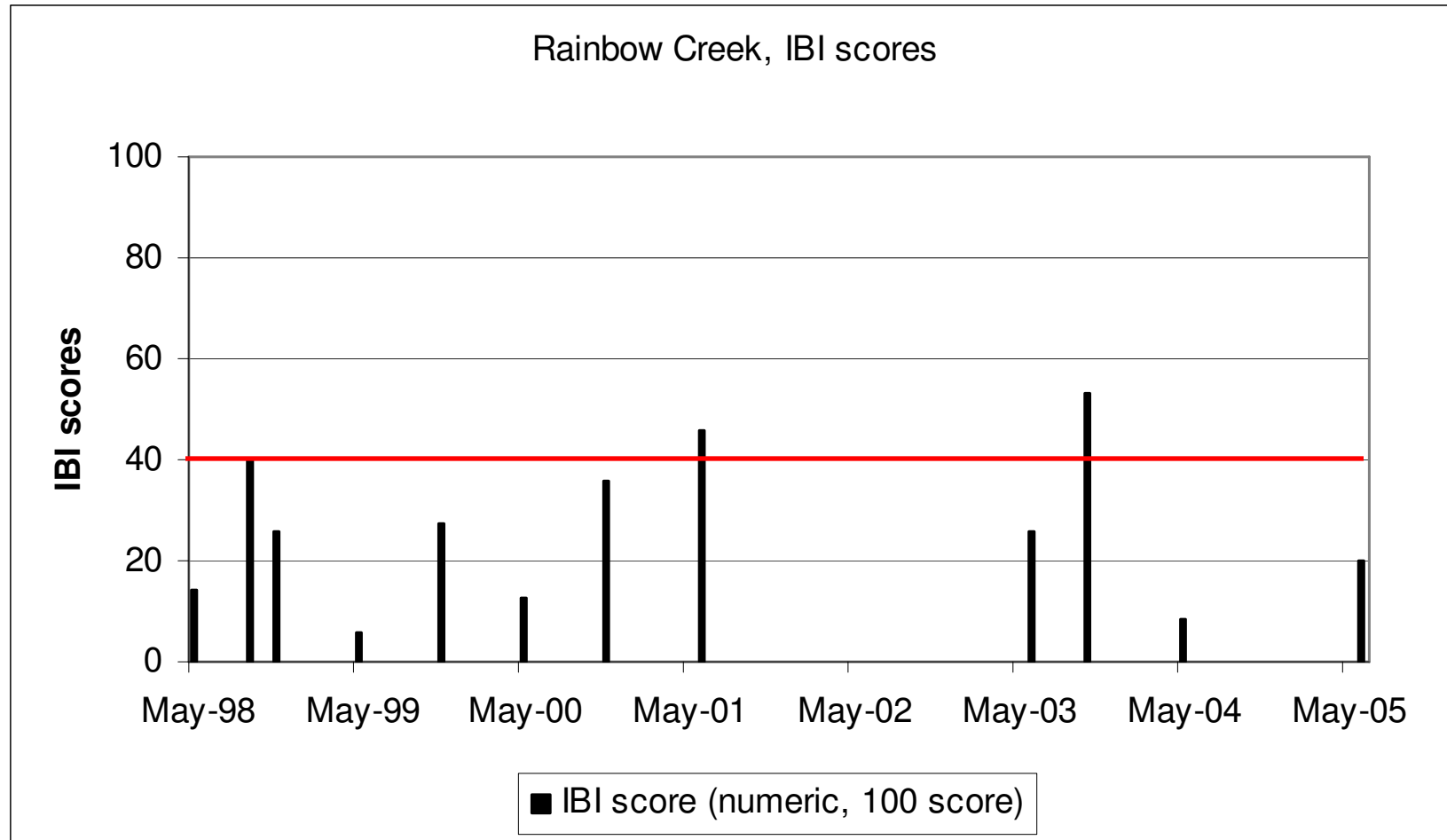

References sites over time

Legend:
- ☐ May-00
- ☐ May-01
- ☐ May-04
- ▦ June-05
- ▦ June-07

Categories: French Creek, North Pine Creek, Troy Canyon Creek

Trends in IBI scores

Escondido Creek, IBI scores

IBI score (numeric, 100 score)

Trends in IBI scores

Rainbow Creek, IBI scores

Correlation with environmental conditions

- Some impairment of physical habitat can explain biological impairment
  - but physical habitat does not always explain biological impairment, e.g. 80% of the sites with good physical habitat show biological impairment

- High biological impairment correlates with areas that use water from the Metropolitan Water District
  - impact of imported water
  - high urbanization

Diagnosis
Urban Stream Condition

- Urbanization is the principal impact
- Current Water Quality Program are ineffective in improving the biological integrity
- Profound need for the next steps
  – stressor identification,
  – LID/Hydromodification Plan implementation,
  – Restoration of receiving waters
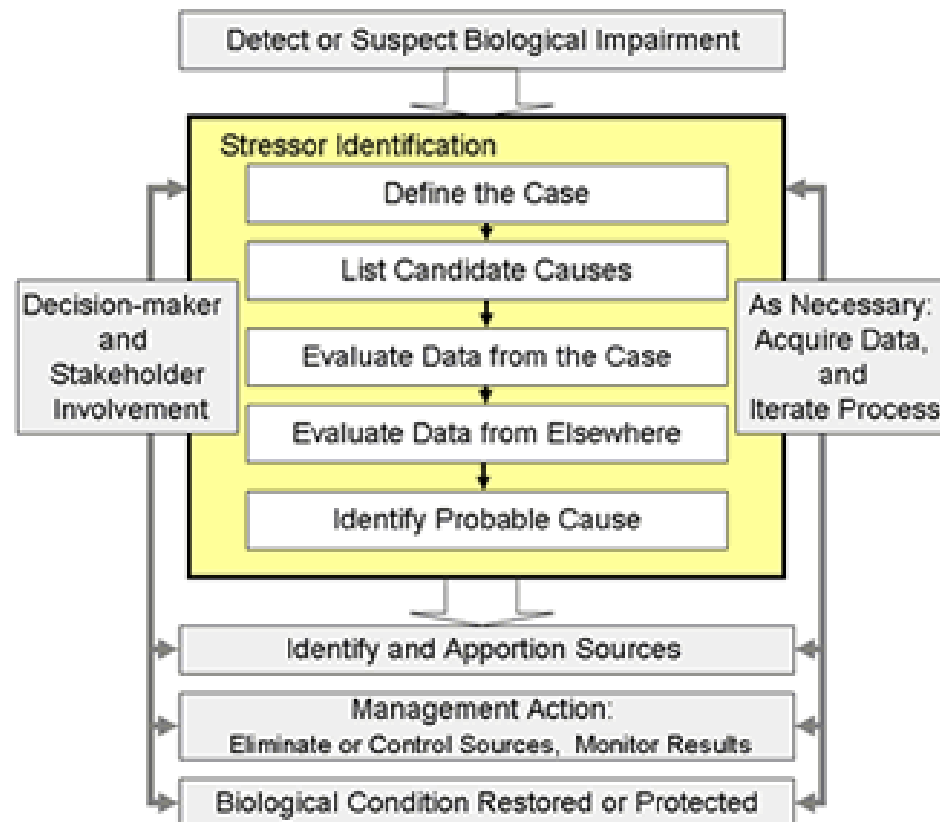 – BMP implementation and evaluation

Next steps

- **Identify the stressors: Stressor Identification**
- Develop a second indicator: the use of periphyton/algae
- Assess the biotic integrity through a probabilistic Design: SMC (**S**tormwater **M**onitoring **C**oalition) study
- Calibrate the SoCal IBI for non-perennial streams
- Adopt narrative biological criteria for San Diego Region (e.g. Oregon model)
- Disseminate the data to the public

Stressor Identification

- EPA's CADDIS (Causal Analysis/Diagnosis Decision System)

Next steps

- Identify the stressors: Stressor Identification
- **Develop a second indicator: the use of periphyton/algae**
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Second Indicator Periphyton

- Multiple biological assemblages are needed
  - different assemblages can be used to indicate different impairments
  - different assemblages integrate over different time scales
- Periphyton responds directly to nutrients
- Periphyton can colonize any stream substratum
- Periphyton responds rapidly to changes in environment

Development of multimetric tools for setting numeric nutrient targets including a periphyton IBI , (Prop.50), Southern California, 2007-2010, SCCWRP, $ 1,476,000

Next steps

- Identify the stressors: Stressor Identification
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- **Assess the biotic integrity through a probabilistic design: SMC (Stormwater Monitoring Coalition) study**
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Probabilistic Design

- SMC study, 24 sites per year in the San Diego region, total of 120 sites within the next 5 years

- Benthic macroinvertebrates and periphyton

- Start: spring 2009

- Funding: trade-off from stormwater permit, stormwater copermittees, SWAMP

Next steps

- Identify the stressors: Stressor Identification
- Develop a second indicator: the use of periphyton/algae
- Assess the biotic integrity through a probabilistic design: SMC (Stormwater Monitoring Coalition) study
- **Calibrate the SoCal IBI for non-perennial streams**
- Adopt narrative biological criteria for San Diego Region (e.g. Oregon model)
- Disseminate the data to the public

Nonperennial streams

Legend

Freeways

Updates to NHD

Nonperennial

Mixed

Perennial

NHD flowlines

Nonperennial

Perennial

Unknown

- <u>Ensuring biological integrity in nonperennial streams</u> (Prop.50), Southern California, 2007-2010, SCCWRP, $ 400,000

Next steps

- Identify the stressors: Stressor Identification
- Develop a second indicator: the use of periphyton/algae
- Assess the biotic integrity through a probabilistic design: SMC (Stormwater Monitoring Coalition) study
- Calibrate the SoCal IBI for non-perennial streams
- **Adopt narrative biological criteria for San Diego Region (e.g. Oregon model)**
- Disseminate the data to the public using EcoLayers

Biocriteria

Biocriteria: Narrative descriptions or numeric values of the structure and function of aquatic communities in a water body necessary to protect the aquatic life use, implemented through water quality standards

Oregon:

Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.

Without detrimental changes in the resident biological community = means no loss of ecological integrity when compared to natural conditions at an appropriate reference site or region.

Next steps

- Identify the stressors: Stressor Identification
- Develop a second indicator: the use of periphyton/algae
- Assess the biotic integrity through a probabilistic design: SMC (Stormwater Monitoring Coalition) study
- Calibrate the SoCal IBI for non-perennial streams
- Adopt narrative biological criteria for San Diego Region (e.g. Oregon model)
- **Disseminate the data to the public**

Dissemination of data

All bioassessment data for the San Diego region are loaded into EcoLayers, a web-based decision support tool that integrates maps, data, documents, and images.

Questions?

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